International Water Management Institute

Al Murunah Webinar on High-Resolution Climate Change Downscaling for Resilient Nature-Based Water Solutions in the MENA Region

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International Water Management Institute (IWMI)

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Project

Al Murunah: Building Climate Resilience through Enhanced Water Security in MENA is a five-year project funded by the UK Government and implemented by the International Water Management Institute (IWMI) in partnership with the International Union for Conservation of Nature (IUCN). The aim of Al Murunah is to enhance water security in Egypt, Jordan, Lebanon, and the Occupied Palestinian Territories (OPT) by integrating nature-based solutions for water and agricultural water management.

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Acronyms

BCSD	Bias-Corrected Statistical Disaggregation
CBO	Community-Based Organization
CEDARE	Centre for Environment and Development for the Arab Region and Europe
FCDO	Foreign, Commonwealth, and Development Office
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
MENA	Middle East and North Africa
OPT	Occupied Palestinian Territories
PHG	Palestinian Hydrology Group
RNBWS	Resilient Nature-Based Water Solutions
SPEI	Standardized Precipitation Evapotranspiration Index
SPNL	Society for the Protection of Nature in Lebanon
SSP	Shared Socioeconomic Pathway
NPAC	National Project Advisory Committees
OPT	Occupied Palestinian Territories
PHG	Palestinian Hydrology Group
RNBWS	Resilient Nature-based Water Solutions
SPNL	Society for the Protection of Nature in Lebanon
TOC	Theory of Change
TWW	Treated Wastewater
UKMO	Met Office, UK
UNDP	United Nation Development Programme
UNFPA	United Nations Population Fund

Executive Summary

The Al Murunah project seeks to improve water security in Egypt, Jordan, Lebanon, and the Occupied Palestinian Territories (OPT) by integrating nature-based solutions for water and agricultural water management strategies (Resilient Nature-Based Water Solutions, RNBWS). The "High-Resolution Climate Change Downscaling for Resilient Nature-Based Water Solutions in the MENA Region" webinar showcased the Al Murunah Project's groundbreaking findings and insights that can shape the future of sustainable water management in the region.

The webinar's aims were to: 1) disseminate technical findings from high-resolution, bias-corrected climate change downscaling activities (full report and data available here) and 2) describe how they are being used in the Al Murunah pilot projects and can be used more widely. It focused on how data-driven insights are informing the planning and implementation of resilient nature-based water solutions (RNBWS) demonstration projects in the four pilot basins of Abu Al-Matamir (Egypt), Wadi Seer (Jordan), Ras Baalbeck Basin (Lebanon) and Wadi Al-Faria'a (OPT).

The webinar highlighted the need for localized, high-resolution (temporal and spatial) climate data to address the MENA region's unique challenges. The study data is instrumental not only for sustainable water management but also for driving broader climate resilience initiatives rooted in community engagement. A key highlight of the webinar was the presentation of the Bias-Corrected Statistical Disaggregation (BCSD) method, a cutting-edge approach for generating precise and more accurate climate projections. The model outputs explain the rising intensity of extreme weather events such as heatwaves and droughts, underscore the need for proactive planning and interventions.

The importance of partnerships in turning these findings into actionable solutions was also underscored. Local communities play a central role in the project, with their insights ensuring that interventions are context-specific and sustainable, while gender inclusion and diverse stakeholder consultations are critical for equitable outcomes, particularly in addressing the needs of vulnerable populations.

Summary of proceedings:
The webinar commenced with an introduction from FCDO, which underscored the need for community action in climate change interventions and pointed out that sustainability can be met only through community ownership, gender inclusion and diverse stakeholder consultations. IWMI's role in piloting inclusive climate solutions was seen as vital to ensure equitable and sustainable climate solutions.

Climate downscaling supports three core pillars: piloting RNBWS, building capacity for climate adaptation, and enhancing the enabling environment through policy alignment. Downscaled data aids in designing interventions appropriate for current and future climate scenarios. The study employed the BCSD method to generate high-resolution climate projections across four pilot basins in Jordan, Lebanon, OPT, and Egypt. Key findings highlight rising temperatures, reduced precipitation, and increased drought risk, which significantly affect agricultural productivity and water management.

Pilot Projects and Implementation
- **Lebanon:** Flood management, solar-powered demonstration farm, afforestation plan.
- **OPT:** Spring rehabilitation, agro-biodiversity garden with market space, improved water management infrastructure, and formation of a water user association.
- **Egypt:** Farm system enhancement to address increasing salinity, temperature, and water scarcity, formation of a water user association, and value chain and marketing enhancement.
- **Jordan:** Rehabilitation of spring and irrigation systems, formation of cooperative, and support for sustainable agricultural practices and water use.

Partners demonstrated the community-centric approach adopted in designing sustainable solutions, particularly with women and youth participation, which are essential for long-term success. Insights from pilot projects will be used to inform national strategies and scaling opportunities across similar regions.

The outcomes from this webinar fed into broader discussions at Cairo Water Week and future events under the Al Murunah Project. Recommendations from pilot interventions will inform policy and investment frameworks to support resilient and sustainable solutions in the MENA region.

1. Introduction

The webinar *High-Resolution Climate Change Downscaling for Resilient Nature-Based Water Solutions in the MENA (Middle East and North Africa) Region* held on October 7, 2024, marked a key milestone in the Al Murunah Project. The event served as a dynamic platform to share groundbreaking findings and insights that are shaping the future of sustainable water management. The audience comprised a wide range of stakeholders, including government officials, development professionals, applied researchers in the climate, water, and food nexus, as well as representatives from donors and potential scaling partners.

The webinar built upon the outcomes of a regional workshop held earlier this year and aimed at bringing the technical findings of high-resolution, bias-corrected climate change downscaling activities to a broader audience. The event showcased how these data-driven insights are being applied to plan and implement Resilient Nature-Based Water Solutions (RNBWS) demonstration projects in key pilot basins across Egypt, Jordan, Lebanon, and the OPT.
The critical need for localized, high-resolution climate data was highlighted in addressing the unique challenges of the MENA region. This data will not only support sustainable water management practices but also inform broader climate resilience initiatives that prioritize community engagement.

Throughout the three-day event, participants engaged in insightful discussions, interactive dialogues, and hands-on exercises to promote collaboration and drive objective outcomes. From national updates on pilot projects to in-depth conversations on market-led upscaling, institutional integration, and gender transformation, the workshop agenda reflected the diverse aspects of RNBWS implementation. Moreover, the workshop provided a valuable opportunity for stakeholders to network, forge partnerships, and collectively commit to driving positive change in water management practices.

2. Webinar Overview

The webinar followed a structured approach to ensure an inclusive, knowledge-driven, and interactive session. The agenda ensured a structured flow of presentations, panel discussions, and interactive Q&A sessions. Key stakeholders, experts, and policymakers were invited to provide diverse perspectives on climate resilience and water management. An interactive Q&A session facilitated knowledge exchange, with participants raising technical, policy-related, and implementation-specific questions, which were addressed by expert panelists. The webinar commenced with an introduction by Stephen Fragaszy, Al Murunah Project Lead, Opening Remarks by Vidhisha Samarasekara, Strategic Program Director, Water Climate Change and Resilience, IWMI, and Al Murunah Project Director, and Keynote Presentation on Climate Change Downscaling and the Role of Community by Tara Finn, Climate and Environment Policy & Programme Manager, FCDO.

Then the technical session by Karim Bergaoui, Meteorologist and Climate Change Modeler (Consultant), International Water Management Institute (IWMI), focused on climate change downscaling approaches and results. It included an overview of downscaling, where the climate change baseline and downscaling process and key outputs and findings were presented. The pilot project highlights included presentations by each country implementation partner where they provided insights on how the downscaled projections are influencing on-ground activities and designs.

- Lebanon (Ras Baalbeck Basin) by Hakam Mandouri, Climate Change and Resilience Officer, IUCN;
- OPT (Wadi Al-Faria'a) by Ayman Rabi, Executive Director, PHG;
- Egypt (Abu Al-Matamir) by Amr Abdeel, Environmental Governance Programme Director, CEDARE; and
- Jordan (Wadi Seer Springs) by Faizah Slehat, Nature-Based Solutions Manager, IUCN

The floor was then opened for interactive Q&A and discussions where participants and panellists actively engaged. The summary of key takeaways and closing remarks was made by Stephen, Al Murunah Project Lead, concluding with the Vote of Thanks by Wasudha Abeyrathna, Project Coordinator, IWMI.

3. Workshop Proceedings

3.1 Welcome and Introduction

Stephen Fragaszy, International Researcher, IWMI and Al Murunah Project Lead

Commencing the webinar, Stephen gave a brief introduction of the purpose for the webinar. He explained that the event originated from the Al Murunah regional workshop held earlier in the year in which stakeholders queried on how specifically the climate change downscaling data was being used in the project. Scientists and applied researchers call for better downscaling information, but often policymakers and other stakeholders don't know how these data can be practically utilized. The webinar aimed to tackle these matters by exploring the generation, significance, and application of downscaling data in a variety of manners.

3.2 Opening Remarks

Vidhisha Samarasekara, Strategic Program Director for Water, Climate Change, and Resilience, IWMI and Al Murunah Project Director

Vidhisha introduced Al Murunah as one of IWMI's flagship projects in the MENA region. The project's overarching goal is to increase water security in the MENA through the implementation of resilient, nature-based water solutions in the face of climate change and land degradation.

Vidhisha outlined the three core pillars of the project. The first is implementing resilient nature-based water solution pilots in agricultural communities, designed to ensure interventions are appropriate for the climate of today and of the next generation. The second focuses on supporting capacity building and innovation adoption among pilot communities and national stakeholders. The project provides results and information which can be readily used by stakeholders, including farmers, water managers, and cooperative associations. The third pillar involves enhancing the enabling environment through national policies and scaling strategies to better plan for climate change adaptation. She described how project partners would share insights on how downscaling data was integrated into the pilot projects in each country.

3.3 Keynote Presentation

Climate Change Downscaling and the Role of Community

Tara Finn, Climate and Environment Policy and Programme Manager, FCDO

Tara began by addressing the centrality of community in climate action. She explained that the heart of localizing adaptation is community, and community is essential to climate change action. She illustrated her point with an anecdote: "We've all heard of examples of a well being dug, and nobody uses it. Why? Because nobody had consulted the community in the first place to find out what they needed." Community involvement is key as local communities provide

invaluable insights into the contextual needs and priorities, ensuring project relevance and sustainability, and that long-term success of climate change actions requires community ownership of interventions.

She observed that too many projects are successful during their lifetime but a few years later become inactive. To avoid this outcome, she emphasized the necessity of community buy-in, highlighting the role of gender inclusion during consultations to foster equitable outcomes.

Discussing challenges in the MENA region she mentioned disproportionate water scarcity (6.3% of the global population but only 1.4% of freshwater resources) and lack of international climate finance and the need to refine and develop further evidence-based tools for decision-making in this space. Tara further urged the use of robust data and participatory methods to address climate impacts effectively. She praised Al Murunah's inclusive approach and emphasized that this is the best way to deliver sustainable and equitable solutions targeting whole communities.

3.4 Technical Session

Climate Change Downscaling Approaches and Results

By Karim Bergaoui, Meteorologist and Climate Change Modeler (Consultant), IWMI

Karim delivered a detailed presentation on the climate change downscaling process and its applications. He began by explaining the limitations of global climate models (GCMs), which operate at coarse spatial resolutions of 100–200 kilometers. Bringing in the analogy of a low-resolution camera, he explained that precise location-specific details are not available from global models. The Bias Corrected Statistical Disaggregation (BCSD) technique was used in the project. This method involves correcting biases in GCM outputs and generating high-resolution projections for temperature and rainfall. Data sources included ERA5-Land for temperature and MSWeb for rainfall, chosen for their reliability and regional relevance. He noted that MSWeb was the best product fitted for the region.

Using detailed graphs and data, Karim presented projections for four pilot basins—Ras Baalbeck (Lebanon), Wadi Al-Faria'a (OPT), Wadi Al-Seer (Jordan), and Abu Al-Matamir (Egypt). In Wadi Al-Faria'a, for example, the high-emission SSP8.5 scenario predicted a temperature increase of up to 4.7 °C by 2090. This warming trend, he explained, would significantly impact agricultural productivity and water demand. He emphasized that such a significant rise in temperature will have major implications.

He also addressed potential stakeholder concerns about the reliability of downscaling results given the absence of long-term ground observations in the pilot sites. Reanalysis data was used, which combine models and remote sensing data and are validated in many regions, including MENA, enhancing data reliability. However, challenges in verifying downscaled data due to limited long-term ground observations were also discussed.

Key Findings

- Rising temperatures by 2090, where maximum temperatures could increase by 4.3 °C–5.2 °C across the pilot regions.
- Reduced precipitation. Annual rainfall may decrease by 7–22%, intensifying drought risks.
- Increased extreme events, with more frequent heatwaves, prolonged dry spells, and severe droughts.
- Significant impact on agricultural productivity, water resource management, and biodiversity conservation.

3.5 Pilot Project Highlights

Lebanon (Ras Baalbeck Basin)

By Hakam Mandouri, Climate Change and Resilience Officer, IUCN

Ras Baalbeck Basin, Lebanon

Key points

- Flood management using small-scale natural dams (gabions) also associated with groundwater recharge, solar-powered demonstration farms, and planning for afforestation with native species.
- Downscaled data enables:
  - Flood risk mapping under climate change scenarios.
  - Improved hydrological models for adaptive water management strategies.

The Ras Baalbeck pilot project addresses flood management, agriculture, and afforestation in a sub-basin of the 260-square-kilometer watershed with elevations ranging from 700 to 2,600 meters. It includes small-scale natural dams for flood control, a solar-powered agricultural demonstration farm introducing modern irrigation and cropping techniques, and plan for afforestation using native species for soil stabilization, flood management, and carbon sequestration. Community empowerment, particularly through women-led cooperatives, is integral.

The project uses a three-stage flood management design process incorporating hydrological and hydraulic modelling, stakeholder consultations, and climate change downscaling. These models, based on historical and downscaled climate data, enable flood risk mapping and long-term water management strategies to address future climate scenarios.

Hakam delved into flood management incorporated into the Ras Baalbeck pilot using small-scale natural dams, while noting the pilot also included planning for afforestation with native species and establishment of a solar-powered demonstration farm. The project area in Lebanon is located in the northeastern part of Lebanon, specifically in Ras Baalbeck, Hermal Governorate. The project area lies within the villages of Ras Baalbeck and Qaa. Since the project is dealing with a basin, it intersects with the administrative boundaries within the two aforementioned villages. The basin is subdivided into several watersheds. Ras Baalbeck is the upstream while Qaa downstream. Precipitation varies from 200 to 450 mm per year, and the population of the two villages is around 29,000 registered inhabitants.

Hakam focused on the pilot's flood management measures to explain how the climate change downscaling study will be incorporated in the pilot project. To date, the project developed a hydrological and hydraulic model using available data. Then the project designed gabion interventions based on IUCN's global nature-based solutions standard and international guidelines on natural and nature-based features for flood risk management. The design was verified through consultation meetings with key stakeholders and field visits to assess the efficacy and sustainability of existing flood management strategies. The designed flood management measures were based on historical climate data from weather stations, literature and open data sources.

The climate change downscaling data will enable the project team to broaden the flood management planning process through basin-scale flood mapping incorporating climate change scenarios. The climate change data will be integrated into the hydrological and hydraulic models to broaden the scale of analysis and enable informed flood management planning in the entire basin, thereby proposing targeted measures that address both current and future flood hazards.

As a summary, the flood management plan that is based on climate change scenarios will eventually guide the implementation of long-term adaptive water management strategies and directly address flood risks under future climate. Downscaled data will enable broader flood risk mapping and improved hydrological modelling for adaptive water management strategies.

Occupied Palestinian Territories (Wadi Al-Faria'a)

By Ayman Rabi, Executive Director, PHG

Wadi Al-Faria'a, OPT

Key points

- Spring rehabilitation, agro-biodiversity gardens, and improved irrigation systems.
- Downscaled data guides:
  - Crop selection for drought resistance.
  - Water management strategies to mitigate reduced groundwater recharge and increased evapotranspiration.

The Wadi Al-Faria'a pilot focuses on spring rehabilitation, agro-biodiversity gardens, and improved irrigation in a 45-square-kilometer catchment supporting 12,000 residents. Initiatives include removing rubble from springs, constructing reservoirs, and creating flood protection embankments. The proposed agro-biodiversity garden will preserve native species, raise environmental awareness, and provide women with kiosks to sell products. Solar lighting and bio-toilets will maintain ecological integrity.

Downscaled data reveals rising temperatures, decreased precipitation, and prolonged droughts, impacting crop water requirements, groundwater recharge, and biodiversity. These projections inform interventions such as training for crop selection and irrigation techniques, alternative water sources, and mitigation measures. The establishment of a Water User Association ensures sustainable water allocation and stakeholder capacity building. The pilot fosters community engagement, supporting both immediate benefits and long-term resilience.

Ayman presented the incorporation of climate change downscaling into the pilot project in the Al-Faria'a upper catchment of the northern West Bank in the Occupied Palestinian Territories. It includes three communities, Ras Al-Faria'a, Faria'a refugee camp, and Wadi Al-Faria'a with a total population of about 12,000.

The project is planning to convert the spring area into a living environmental space. This requires rehabilitating the spring source by removing rubble, letting the water flow all year, and providing protection to the spring source in order to prevent intrusion or pollution to the springs. Part of the irrigation canal that conveys the spring water downstream to the agricultural land will also be rehabilitated. A small reservoir will be built for farmers, so that they can regulate the water allocation for farmers during the time that they need it. Protection against flooding includes a channel embankment so that the wadi channel is used to discharge the excess flood water, and to avoid intrusion into the spring area.

In addition, the pilot will create an agro-biodiversity garden, which will preserve and help people learn about their native species and biodiversity in the area. A small space will be promoted for women to market their products in kiosks. Therefore, the pilot will not only create a natural space, but also a community space where people can come and appreciate the beauty of the setting at the same time. Solar energy lighting will be used along with bio toilets to maintain the environmental and ecological identity of the space.

A water user association will be promoted to help manage spring water among the farmers. Also, public awareness raising will take place to preserve the area, as well as building the capacity of the local council and the water user association.

Ayman said that the climate change data indicates significant effects on the area, especially via temperature increases that will have an impact on crop water requirements, agricultural water management, and crop flowering periods. Also, the decrease in precipitation means lower groundwater recharge, therefore affecting groundwater availability and slow spring discharge. It will decrease runoff, which will affect the water harvesting structures that are in the catchment. Finally, the expected increase in extreme weather conditions and events like flash floods will have implications on infrastructure, and it will cause soil erosion.

The pilot design reflects climate change data through the agro-biodiversity garden, which will maintain drought resistant local *baladi*[1] and native plants in an effort to preserve local seeds and maintain agrobiodiversity and resilience. Spring rehabilitation will ensure maintenance of the spring flow all year around. The water user association will help farmers manage and allocate water from the spring to the farmers and to other users. The climate change data will also inform capacity building for farmers and water user association members on crop selection and irrigation management in dry and wet years. Mitigation measures will also be proposed, developed together with the community, to maintain the sustainability of the project as well as the spring, as a nature-based solutions that will also help in promoting the livelihood of the community in general.

Egypt (Abu Al-Matamir)

By Amr Abdel Megeed, Environmental Governance Programme Director, CEDARE

Abu Al-Matamir, Egypt

Key points

- Identified temperature increases and a 7% decline in rainfall as key challenges.
- Proposed interventions:
  - Adoption of drought-tolerant crops and efficient irrigation systems.
  - Establishment of demonstration farms and farmer training programs.

The challenges posed by climate change in Egypt's Nile Delta, particularly in rural agricultural communities, are increasing. From 1980 to 2014, Abu Al-Matamir experienced warming trends, with significant increases in both maximum and minimum temperatures and a rise in the frequency of warm days.

Key pilot interventions include:

- Use of drought-tolerant crops, efficient solar-powered irrigation systems, drainage improvements, and adjusted planting seasons.
- Soil salinity management through amendments like gypsum and the use of salt-tolerant crops and varieties.
- Establishment of demonstration farm with improved irrigation and drainage systems to showcase adaptive agricultural practices.
- Capacity-building programs for farmers, CBOs, and stakeholders on climate-smart practices, soil, and water management.
- Development of a food processing facility for artichokes, creating employment opportunities for women and youth, with annual processing capacities of 1,500 tons.
- Revolving fund to support scaling of project interventions.

These measures aim to enhance community resilience, water conservation, and economic sustainability, addressing both immediate needs and long-term climate impacts.

[1] In Egypt, baladi essentially means indigenous. In terms of agriculture, it refers to fruits, vegetables, or animal products that are grown locally and traditionally, without industrial farming methods. For example, tomato baladi is a seasonal, heirloom tomato grown in open fields.

Amr raised concerns that the Nile Delta is already facing the profound effects of climate change, which is particularly detrimental to rural agricultural communities. He highlighted that those living in poverty, are particularly vulnerable to climate hazards and the negative impacts of long-term natural resource stresses on agricultural and water management systems. The agriculture and water resources face significant challenges in this region due to rising temperatures, changing rainfall patterns and more frequent extreme weather events. High-resolution climate data is crucial for managing these challenges, especially in agriculture and the development of nature-based solutions.
From 1980 to 2014, Abu Al- Matamir has experienced a warming trend. The warmest year on record is 2010, with temperatures 2.5 °C above the average. Both maximum and minimum temperatures have shown a significant increase of 0.3 °C per decade. The number of warm days has increased with an additional 25 days above the 90th percentile and a decrease of 40 days below the 10th percentile over the 30 five-year period. The frequency of warm days, with maximum temperatures above 35 °C, and minimum temperatures above 15 °C has risen by 1.2 days per decade. The findings of the study underscore the critical need for targeted adaptation strategies to address the evolving, climate-related challenges for water resource management, agriculture, and community resilience.

Designing robust local climate change adaptation strategies requires high-resolution climate change projections across various emission scenarios. For example, crop choices and management practices or flood management strategies will vary, depending on expected future conditions. The warming and decreased precipitation trend indicate the use of drought-tolerant crops and varieties, efficient irrigation methods and adjusting sowing seasons to align with the changing climate, such as replacing autumnal crops with winter planting ones. Likewise, the decreasing precipitation trends in Abu Al-Matamir highlight the importance of improved water management interventions and raising community awareness about water conservation.

Soil salinity is a challenge in the pilot project governorate of Beheira and reaches moderate levels in the pilot site. Thus salt-tolerant crops and varieties should be used in combination with some soil treatment, such as soil amendments, gypsum, and improved drainage to enhance production and maintain the soil.

Increasing awareness and building the capacity of farmers and stakeholders is considered one of the most important priorities for implementing the strategy required to adapt to climate change through several training workshops. The proposed topics on climate change and its impact on agriculture, modern techniques on soil and water management, and integrating nutrients and pest management will be presented to farmers, representatives of civil society organizations, community-based organizations, CBOs and extension engineers.

The intervention's main aspects directly connected to climate resilience in agriculture and water management include the establishment of two demonstration farms, each one feddan[2], with adopted crop varieties and practices that will be compared with the control. Additionally, pump and modern irrigation infrastructure will be implemented for another 20 feddan along with conducting farmer field schools in the pilot site and establishing a water user association to manage water distribution at the *mesqa*[3] (tertiary canal) level.

The provision of machinery will help the farmers to be cooperative and reduce climate risks in the area by helping with water savings, crop yield improvement, reduction in cultivation costs, job creation, and improve overall livelihoods and resilience.

Additional interventions focus on improving agricultural processing facilities, market connections, and access to finance, particularly for women and youth.

[2] A feddan is an Egyptian unit of area, equivalent to approximately 1.038 acres (0.42 hectares), and the word comes from the Arabic "faddān" meaning "yoke of oxen".
[3] An Egyptian term for a tertiary-level canal that delivers water from branch canals to agricultural fields.

Jordan (Wadi Seer Springs)

By Faizah Slehat, Nature-Based Solutions Manager, IUCN

Wadi Seer, Jordan

Key points

- Addressing water scarcity through spring rehabilitation, irrigation canal maintenance, and community engagement.
- Downscaled data informs:
  - Sustainable water use practices and infrastructure improvements.
  - Climate-smart agricultural techniques.

Wadi Seer, an urban watershed critical to Amman's water supply, faces challenges such as damaged irrigation infrastructure, illegal water extraction, and conflicts over resource allocation. The region, characterized by its 14 natural springs, suffers from water scarcity exacerbated by climate change, rising temperatures, and decreasing precipitation. Downscaled data projects a warming trend with a temperature increase of 1°C per decade and declining precipitation, further stressing water resources.

Key interventions include:

- Rehabilitation of springs and irrigation canals to prevent water loss and pollution.
- Adoption of climate-smart agricultural practices and efficient water management techniques.
- Formation of women- and youth-led cooperative for agriculture.
- Community engagement and participatory workshops to align local actions with broader resilience goals.

These interventions integrate IUCN's Nature-Based Solutions (NBS) standards, focusing on societal challenges, scalability, biodiversity conservation, and inclusivity. The establishment of an agricultural cooperative involving men and women aims to foster empowerment, equitable resource use, and sustainable development.

Wadi Seer is an urban watershed with significant agricultural areas, spanning 48 square kilometers. and characterized by 14 natural springs that contribute significantly to Amman's water supply. However, the area faces severe challenges, including damaged irrigation infrastructure, illegal water pumping, and conflicts over resource allocation. Faizah described interventions aimed at restoring spring ecosystems, repairing canals, and promoting climate-smart agricultural practices. Local farmers and communities are engaged to adopt sustainable water management techniques. The project includes participatory planning workshops to ensure community involvement in decision-making. Integrating downscaling data has been crucial for designing interventions that address future climate risks.

The eight criteria in the IUCN NBS standard were used in the pilot project design. They provide guidance in how to design any interventions according to nature-based solution.

Already climate change is affecting water availability and agricultural productivity by changing precipitation patterns; increasing droughts, water scarcity, and temperature; and through associated soil degradation. These affect crop yields and impact on water dependent agriculture and the communities dependent on farming. The result of the downscaling study indicates that clear warming trend with daily maximum temperature expected to rise by approximately one 1 °C per decade. Additionally, a decline in precipitation, especially in the late 21st century, is projected leading to potential hydrological drought conditions.

Incorporation of climate change downscaling information can improve RNBWS design, implementation, and long-term success. It can support engagement with local stakeholders and help educate them on climate change impacts and nature-based solutions for resilience. This helps them understand how local actions align with broader resilience goals

and supports policy alignment by using downscaled data to influence policy, ensuring government, plans incorporate climate risk management. After evaluating the pilot success, the approach can be scaled and replicated in similar region, using downscaled climate data to inform each intervention. Downscaling enables the pilot project to anticipate and address future climate change challenges, optimizing interventions for long-term resilience. This proactive approach strengthened the project impact, aligning with environmental and social and economic and sustainability goals.

4. Questions and Answers

Question 1: Modeling Biases in MENA and Globally

Stephen asked Karim to address biases in climate modeling in the MENA region. Karim explained that biases stem from the global scale of climate models, which have resolutions of 100–200 kilometres and therefore cannot accurately represent localized factors such as topography, land use, and crops. These biases are common globally, especially in small basins or regions with complex terrains, making local downscaling crucial.

Question 2: Inclusion of Additional Scenarios (SSP4)

Hakam asked if adding SSP4 scenario would yield significant differences. Karim stated that the scenarios used covered the extremes, so additional scenarios would likely fall within the same range. He added that while regional climate models, like those from CORDEX, could technically be used, they require extensive calibration and sensitivity analysis to avoid inheriting biases from broader climate models. This makes their use resource-intensive and often less reliable without careful adjustments.

Question 3: Comparison of Slope Shades

A participant asked whether comparing sites with different slope shades could produce varying results. Karim explained that climate impacts are highly complex due to interactions between the surface, boundary layers, and atmosphere. Variations in slope shades alone are insufficient to fully explain differences but can lead to substantial localized impacts when combined with other factors. He cited an example where temperature trends differed significantly between two nearby sites, highlighting the need for site-specific studies.

Question 4: Social Methods and Participation Tools

A question about the participatory methods used in the project was addressed by Stephen, who explained that the project adopted a collaborative, community-driven process at every stage. This included problem analysis, visioning, and co-designing solutions with stakeholders. Community input shaped pilot interventions, and the engagement process balanced technical expertise with community-led decisions. Hakam and Amr emphasized that this participatory approach fostered ownership, awareness of nature-based solutions, and stakeholder involvement throughout the project lifecycle. This process continues into scaling efforts, with downscaling data guiding decisions on future interventions, such as cropping patterns and structural designs.

Question 5: Communicating Forecasts and Building Trust

A participant asked how downscaled forecasts were presented to communities and stakeholders and how the project built their trust despite differing short- and long-term priorities. Stephen explained that the pilot projects began with extensive community engagement to identify problems and aspirations. Communities provided feedback on potential interventions, ensuring they addressed immediate needs while incorporating longer-term resilience strategies. Downscaled data informed technical designs and were integrated into capacity-building activities to deepen understanding. Amr added that mathematical models combining downscaled data with agricultural and hydrological information were used to evaluate scenarios, raising awareness about nature-based solutions and creating a sense of ownership within communities.

5. Closing Reflections

Stephen closed the session, thanking the participants for their engagement and the speakers for their detailed presentations. He said that the mission of the Al-Murunah project is to create actionable, inclusive solutions that not only address climate challenges but also empower the communities most affected by them, and to scale these interventions together, for a more resilient future.

He summarized key takeaways and emphasized the importance of leveraging high-resolution climate data for actionable solutions. The critical role of community engagement and partnerships in achieving sustainability was further acknowledged and the next steps were outlines, including incorporating feedback into future project phases and scaling strategies.

Participants expressed their appreciation for the depth and integration of the Al Murunah project and the way it combines technical rigor with community engagement, which can be a model for climate adaptation globally. The webinar successfully highlighted the transformative potential of integrating high-resolution climate data into adaptive water and agricultural solutions. It underscored the need for inclusive, data-driven approaches to address climate change challenges and promote resilience in the MENA region.

Concluding the workshop, Wasudha stated that the presentations underscored the importance of downscaling climate data for local regions to address climate change impacts at the scales where human activities and ecosystem interact. She said that it is crucial to continue leverage these insights as we move forward, not only within the context of the pilot regions, but also for broad application. She stressed that collaboration between research policymakers and practitioners will be key to scaling these solutions and encouraged everyone to use the opportunity to further strengthen networks, share knowledge and take meaningful steps towards a more resilient and sustainable future.

6. Appendices

Appendix 1 – Agenda

Webinar Agenda

#	Agenda item	Duration
1	Introduction to the session and objectives by Stephen Fragaszy, International Researcher at the International Water Management Institute (IWMI) and Al Murunah Project Lead	5 minutes
2	Opening Remarks by Dr. Vidisha Samarasekara, Strategic Program Director, Water Climate Change and Resilience, IWMI, and Al Murunah Project Director	5 minutes
3	Keynote Presentation by Dr. Tara Finn Climate and Environment Policy & Programme Manager, FCDO	5 minutes
4	Technical Presentation on Climate Downscaling Analysis and Results by Dr. Karim Bergaoui, Meteorologist and Climate Change Modeler (Consultant), International Water Management Institute (IWMI)	30 minutes
5	Country Pilot presentations by partners – Application of projections in country-specific interventions - Lebanon (Ras Baalbeck Basin) by Hakam Mandouri, Climate Change and Resilience Officer, IUCN - OPT (Wadi Al-Faria'a) by Dr. Ayman Rabi, Executive Director, PHG - Egypt (Abu Al-Matamir) by Dr. Amr Abdeel, Environmental Governance Programme Director, CEDARE - Jordan (Wadi Seer Springs) by Faizah Slehat, Nature-Based Solutions Manager, IUCN	~5-10 minutes per country
6	Interactive Q&A and Discussions – Stakeholder feedback and engagement	30 minutes
7	Summary of Key Takeaways and Closing Remarks by Stephen Fragaszy, International Researcher Water Climate Change and Resilience, IWMI and Al Murunah Project Lead	5 minutes

Appendix 2 – List of Participants

Table 2A. Participation by country

Country	Attendees
Albania	1
Australia	1
Cameroon	1
Egypt	16
Ethiopia	2
Finland	1
France	3
Greece	1
India	10
Iraq	3
Italy	1
Jordan	16
Kenya	2
Lebanon	6
Morocco	1
Netherlands	1
Pakistan	7
Palestinian Territories	7
Singapore	1
Sri Lanka	12
Thailand	2
Tunisia	3
Uganda	2
United Kingdom	1
Yemen	2
Zambia	1
Total	104

Table 2B. Institutional Affiliations

Affiliated Organization	Reps
Addis Ababa University	1
Arab Organization for Agricultural Development (AOAD)	1
Arinma Holdings Pvt Ltd, Sri Lanka	1
BAIF Development Research Foundation, India	2
BAIF Institute for Sustainable Livelihoods and Development, India	1
Cameroon Wildlife Conservation Society (CWCS)	1
CEDARE, Egypt	1
Desert Research Centre, MoA, Egypt	3
Egyptian Ministry of Environment	1
Environment Quality Authority, Palestinian Territories	1
Faculty of Sciences of Tunis	1
FAO	2
FCDO	2
Flora Syria On Line, Lebanon	1
German Jordanian University, Jordan	1
Holding company for water and waste water in Egypt	1
IWMI	17
KB consulting, Tunisia	1
Kyoga Water Management Zone, Uganda	1
MAEIA – AI Powered Water Loss Management, Morocco	1
Masinde Muliro University of Science and Technology, Kenya	1
Ministry of Environment, Jordan	2
Ministry of Environment, Lebanon	1
Ministry of Water and Irrigation, Jordan	1
Ministry of Water Resources and Irrigation, Egypt	1
Mosul University, Iraq	1
NALCO, Sri Lanka	1
National Development Consultants Pvt. Ltd., Pakistan	1
National Disaster Risk Management Fund, Pakistan	1
National Water Research Center, Egypt	1
Palestinian Hydrology Group (PHG)	2
Palestinian Water Authority	1
Pearl Engineering Company, Uganda	1
RSS, Jordan	1
SLTC, Sri Lanka	1
Société Civile, France	1
Society for the Protection of Nature in Lebanon	2
Thamar University, Yemen	1
UK Met Office	1
UN-Habitat	1
UNDP	1
UNESCAP	1
University of Engineering and Technology Mardan, Pakistan	1
University of Jyväskylä, Finland	1
University of Moratuwa, Sri Lanka	1

Continued >>

Table 2B. Institutional Affiliations (continued)

Affiliated Organization	Reps
University of Ruhuna, Sri Lanka	2
University of Zambia	1
Wageningen University, Netherlands	1
WorldFish, Egypt	1
	74

IWMI
International Water Management Institute

CGIAR
IWMI is a CGIAR Research Center

The International Water Management Institute (IWMI) is an international, research-for-development organization that works with governments, civil society and the private sector to solve water problems in developing countries and scale up solutions. Through partnership, IWMI combines research on the sustainable use of water and land resources, knowledge services and products with capacity strengthening, dialogue and policy analysis to support implementation of water management solutions for agriculture, ecosystems, climate change and inclusive economic growth. Headquartered in Colombo, Sri Lanka, IWMI is a CGIAR Research Center with offices in 15 countries and a global network of scientists operating in more than 55 countries.

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